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Enhancing Immersiveness in Paramedicine Education XR Simulation Design

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Abstract:

The Multiple Environments Simulation Hub (MESH360) research cluster was established in 2016 to explore ways of making critical care simulation environments more authentic learning experiences for students (Cochrane et al., 2016). Since its establishment, three cycles of data collection have occurred exploring immersive mixed reality (XR) to enhance traditional clinical simulation methodologies in Paramedicine education (Aguayo et al., 2018; Cochrane et al., 2020). Using a design-based research (DBR) methodology focused on prototyping in practice to generate design principles (Cochrane et al., 2017; McKenney & Reeves, 2019), along with a mixed-methods and multimodal approach to data collection and analysis in educational research (Cohen, Manion & Morrison, 2011; Lahat, Adali & Jutten, 2015), led the MESH360 team to develop a framework for designing immersive reality enhanced clinical simulation (Cochrane et al., 2020).

Building upon this work, a set of design principles permitted to augment the immersive experience of participants through a case study involving an XR enhanced rescue helicopter simulation experience. Two key components of this enhanced simulation are: (1) a focus on combining XR design principles merging real environment elements with digital affordances (possibilities offered by digital tools and platforms) to provide a range of 'learning points' for different types of learners (i.e., from novice to experienced participants) (Aguayo, Eames & Cochrane, 2020); and (2) a focus on the embodiment of the experience (Aguayo et al., 2018) to maximize the interactivity, authenticity, and realism of the enhanced immersive reality through a sequence of experiences including virtual reality (VR) helicopter ride, simulated manikin work, and critical environmental soundscapes.

Findings from the third cycle indicate an increase in spatial and context awareness across all types of participants, in relation to the authenticity of the XR environment when compared to traditional Paramedicine simulation training. Furthermore, participants also reported an enhanced realism of the 'emergency response' helicopter VR ride, as the sequence of experiences permitted participants to plan their response based on audio cues and information updates while virtually 'traveling to the scene'. This iterative research work has led the MESH360 project to validate the set of transferable design principles and implementation framework for the design of authentic critical care simulation environments in Paramedicine education.

Here we present and discuss a series of implications and benefits from the third MESH360 cycle in Paramedicine education emerging from the framework for designing XR enhanced clinical simulation. Anecdotic yet relevant data in relation to participant demographics and VR anxiety has led the MESH360 team to explore culturally-responsive practice in XR simulation in Paramedicine education (see Aiello et al., 2021). Future directions and transferability to other health and medical contexts are also discussed.

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